



It is obvious that minor changes may be made in the form and construction of the invention without departing from the material spirit thereof. It is not, however, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

What is claimed is:

- 1. (Currently Amended) A remote piloting system configured for an onboard, manned piloted aircraft comprising:**
 - a) an operational aircraft or a plurality of operational aircraft with equipment to interface with a ground-based aircraft simulator;**
 - b) a ground-based aircraft simulator or a plurality of ground-based simulators, that dynamically mimics the displays and controls of operational aircraft (a) and configured for a pilot in the simulator to remotely take over the piloting function of operational aircraft (a);**
 - c) a sensor multiplexer receiver and transmitter means located onboard aircraft (a) for accepting said aircraft performance and control parameters that are required by a ground-based simulator to replicate the major control and performance states of aircraft (a), and then, when necessary, convert said performance and control parameters into digital format, add a unique aircraft identification, ID, to an outgoing radio frequency, RF, signal and broadcasting said outgoing RF signal to a Central Ground-Based processing Station (CGBS) which then transfers the aircraft performance and control data to a ground-based aircraft simulator (b);**
 - d) a ground-based aircraft simulator digital processor/computer that is configured to provide the computational and conversion capability to dynamically reproduce displays that exist in the operational aircraft (a) onto the displays in the simulator and converts the remote piloting controls of the ground-based simulator for conning/guiding operational aircraft (a);**

- e) **remote pilot control avionics that permit a pilot sitting in the ground-based aircraft simulator (b) to control the piloting of an operational aircraft (a);**
- f) **a ground-based aircraft simulator Flight Control Unit (FCU), and/or any combination of the following:**
 - 1. **ILS,**
 - 2. **Autopilot/Flight Director (FD),**
 - 3. **Autothrottle,**
 - 4. **Autobrake,**
 - 5. **Thrust Control,**
 - 6. **Steering Control, and**
 - 7. **Landing-gear Control****configured to bring operational aircraft (a) to a safe landing and stopped by the remote pilot;**
- g) **a remote pilot electronic interface unit located on aircraft (a) that recognizes that the remote pilot aircraft simulator (b) has uniquely specified and selected aircraft (a) , from a plurality of operational aircraft, based on the electronic interface unit recognizing the operational aircraft's (a) unique ID, as the vehicle to be remotely piloted;**
- h) **a remote pilot electronic interface unit (g) that provides the interfaces to control the aircraft's (a) FCU and/or any combination of the following:**
 - 1. **ILS,**
 - 2. **Autopilot/ Flight Director (FD),**
 - 3. **Autothrottle,**
 - 4. **Autobrake,**
 - 5. **Thrust Control,**

6. Steering Control, and

7. Landing-gear Control

configured to bring operational aircraft (a) to a safe landing and stopped by the remote pilot;

- i) a ground-based aircraft simulator (b) that via ground to air telemetry, directed through the CGBS, with operational aircraft (a) and electronic interfaces (g) and (h) provides the electronic signals that control operational aircraft's (a) FCU and/or any combination of the following:**

- 1. ILS,**
- 2. Autopilot/ Flight Director (FD),**
- 3. Autothrottle,**
- 4. Autobrake,**
- 5. Thrust Control,**
- 6. Steering Control, and**
- 7. Landing-gear Control**

configured to bring operational aircraft (a) to a safe landing at a remote pilot designated airfield and stopped;

- j) a unique aircraft identification, ID, and configuration system which permits two-way RF communication between a ground-based aircraft simulator and a specific operational aircraft (a) that is functioning among a plurality of operational aircraft;**
- k) a parsing system in the CGBS based on aircraft's (a) unique ID (j) that allows information going to the CGBS to be parsed so that aircraft (a) is uniquely identified from a plurality of operational aircraft and utilized in the remote pilot simulator (b);**
- l) a ground to air and air to ground two-way RF communication system that allows unique communication between specified**

- operational aircraft (a) and a ground-based aircraft simulator (b) based on the unique ID (j) of operational aircraft (a); and**
- m) a remote pilot's display, located in the ground-based simulator (d), that dynamically mimics the critical conning displays of operational aircraft (a).**
- 2. (Currently Amended) A remote pilot system, as in claim 1, in which a ground-based simulator has voice and /or digital data communication with air traffic control/management (ATC/M).**
- 3. (Currently Amended) A remote pilot system, as in claim 1, equipped with an aircraft display and control advisory system located onboard the operational aircraft in which the:**
- a) operational aircraft onboard pilot notifies, via telecommunication, the remote pilot located in the ground-based simulator, of the onboard pilot's desire for the remote pilot to assume the piloting function of the operational aircraft;**
 - b) remote pilot located in a ground-based simulator notifies, via telecommunication, the operational aircraft onboard pilot that the remote pilot has taken the piloting function over and that the operational aircraft piloting function is now under the control of the remote pilot;**
 - c) remote pilot in the ground-based simulator notifies, via telecommunication, the onboard pilot in the operational aircraft that the piloting function of the operational aircraft will be delegated back to the onboard pilot at a designated time; and**
 - d) operational aircraft onboard pilot notifies, via telecommunications, the remote pilot in the ground-based simulator of the onboard pilot's desire to assume the piloting function of the operational aircraft.**
- 4. (Currently Amended) A remote pilot system, as in claim 1, equipped with an aircraft display and control advisory system located onboard the operational aircraft in which the operational aircraft onboard pilot, using a coded message for a terrorist notifies, via telecommunication, the remote**

pilot located in the ground-based simulator to immediately assume the piloting function of the operational aircraft.

- 5. (Currently Amended) A remote pilot system, as in claim 1, equipped with an aircraft display and control advisory system located onboard the operational aircraft in which the operational aircraft onboard pilot using a coded message for a dire aircraft problem notifies, via telecommunication, the remote pilot located in the ground-based simulator to immediately assume the piloting function of the operational aircraft.**
- 6. (Currently Amended) A remote pilot system, as in claim 1, equipped with a remote pilot display and control advisory system located in the remote pilot simulator in which the:**
 - a) operational aircraft onboard pilot notifies, via telecommunication, the remote pilot in the ground-based simulator of the onboard pilot's desire for the remote pilot to assume the piloting function of the operational aircraft;**
 - b) remote pilot in the ground-based simulator notifies, via telecommunication, the operational aircraft onboard pilot that the remote pilot has taken the piloting function over and that the operational aircraft piloting is now under the control of the remote pilot;**
 - c) remote pilot in the ground-based simulator notifies, via telecommunication, the operational aircraft onboard pilot that the piloting function of the operational aircraft will be delegated back to the onboard pilot at a specified time; and**
 - d) operational aircraft onboard pilot notifies, via telecommunication, the remote pilot in the ground-based simulator of the onboard pilot's desire to assume the piloting function of the operational aircraft.**
- 7. (Currently Amended) A remote pilot system, as in claim 1, in which an air traffic control/management (ATC/M), weather, map, terrain, security and airline communication system allows the remote pilot's simulator to**

reproduce the communication, data and displays available in the operational aircraft in claim 1.

- 8. (Currently Amended) A remote pilot system, as in claim 1, in which the remote pilot in the simulator has the ability to communicate directly via a ground-based digital data link with ATC/M, a weather source, a map source, a terrain source, security, airline and aircraft manufacturer.**
- 9. (Currently Amended) A remote pilot system, as in claim 1, in which the RF digital two-way (to and from) communication system between the remote pilot and the operational aircraft is a regional digital data link (less than 1000 miles).**
- 10. (Currently Amended) A remote pilot system, as in claim 1, in which the:**
 - a) RF digital two-way (to and from) communication system between the remote pilot and the operational aircraft is a nationwide digital data link; and**
 - b) communication system (a) has a minimum of a 500 mile extension beyond national borders.**
- 11. (Currently Amended) A remote pilot system, as in claim 1, in which the:**
 - a) RF digital two-way (to and from) communication system between the remote pilot and the operational aircraft is a global digital data link; and**
 - b) communication system consists of an in atmosphere RF communication, as via a global satellite data link or ground to aircraft directly, or a combination of atmospheric RF communication and a ground digital data link consisting of optical fiber and wire digital data transmission.**
- 12. (Currently Amended) A remote pilot system, as in claim 1, in which the ground-based remote pilot simulator for emergency mitigation, development and training purposes interfaces directly with the operational aircraft (a) and/or an air carrier or aircraft manufacturer's**

simulation capability such that it artificially produces a computer generated aircraft piloting environment.

- 13. (Currently Amended) A remote pilot system, as in claim 1, in which the ground to air RF communication system allows simultaneous communication of emergency or warning messages from the remote pilot simulator to all operational aircraft.**
- 14. (Currently Amended) A remote pilot system, as in claim 1, in which both the RF communication and the ground communication are secure and can have either one of, or any combination of, the following:**
 - a) a ciphered communication system that allows for periodically changing the code to be utilized in the communication system;**
 - b) an anti-spoof communication system that reasonably prevents data from being misinterpreted; and**
 - c) an anti-jam communication system that reasonably prevents the data communication from being intentionally jammed or jammed by naturally occurring RF noise/interference signals.**
- 15. (Currently Amended) A remote pilot system, as in claim 1, supplemented with:**
 - a) a remote pilot simulator that simulates the control of the aircraft's control surfaces (ailerons, flaps, spoilers, rudder, etc.), thrust controls, landing-gear controls, steering, braking controls, etc. so as to permit the remote pilot, via telemetry to the aircraft, to take manual control of the aircraft just as if the remote pilot was the onboard pilot; and**
 - b) an operational aircraft interface which includes control surfaces (ailerons, flaps, spoilers, rudder, etc.), thrust controls, landing-gear controls, steering, braking controls, etc., that permits the signals coming from the remote pilot, via telemetry to the aircraft, to be manually controlled by the remote pilot both on the ground for taxiing as well as during flight.**

16. ~~(Withdrawn Currently Amended)~~ A remote pilot system, as in claim 1, configured with a high fidelity synthetic vision remote pilot simulator windshield display, or windshield wraparound display, or goggles/glasses with a resolution and refresh rate to accurately and dynamically depict, in real-time, digitized map data, or terrain data or topographic data, or elevation data, or airport ground traffic data, or in-air traffic data or any combination of said data items.
17. ~~(Withdrawn Currently Amended)~~ A remote pilot system, as in claim 1, where the digital processor/computer program is arranged to accurately and dynamically depict, in real-time, digitized map data, or terrain data, or topographic data, or elevation data, or airport ground traffic data, or in-air traffic data or any combination of said data items.
18. (Withdrawn) A high fidelity synthetic vision remote pilot simulator windshield display that superimposes airport ground traffic and/or air traffic on the simulator's windshield display from the local airport's traffic control system's real-time data system.
19. (Withdrawn) A high fidelity synthetic vision remote pilot simulator windshield display or windshield wrap-around display supplemented with dynamic representations of surrounding ground and in-air vehicles that are superimposed on the display based on ATC/M supplied digital data such that it permits the remote pilot in the simulator to reasonably see the aircraft's environment similar to the onboard pilot in the actual aircraft which is/will-be remotely controlled.
20. (Withdrawn) A high fidelity synthetic vision remote pilot simulator windshield display or windshield wrap-around display supplemented with dynamic representations of surrounding ground and in-air vehicles that are superimposed on the display based on topographic and airport digital data, from a data base, such that the remote pilot in the simulator sees the aircraft environment similar to the pilot in the actual aircraft which is/will-be remotely controlled.

- 21. (Withdrawn) High fidelity synthetic vision remote pilot virtual reality goggles/glasses that superimpose the ATC/M supplied digital data such that the remote pilot reasonably sees the aircraft environment similar to the onboard pilot in the actual aircraft which is/will-be remotely controlled.**
- 22. (Withdrawn) High fidelity synthetic vision remote pilot virtual reality goggles/glasses that superimpose topographic and airport digital data, from a digital data base, such that the remote pilot in the simulator sees the aircraft environment similar to the pilot residing in the actual aircraft.**
- 23. (Currently Amended) A remote pilot system, as in claim 1, in which the:**
- a) remote pilot can command an in-flight operational aircraft to be put on autopilot;**
 - b) commanded aircraft (a) will retain the last remote pilot's command, memorize it and stay on the remote pilot's designated trajectory until it receives another remote pilot command to alter the designated trajectory;**
 - c) remote pilot can concurrently and/or consecutively command a plurality of aircraft (a) to varying trajectories by putting each unique ID aircraft on autopilot;**
 - d) remote pilot can individually take control of a unique ID operational aircraft (a) that is on autopilot, while the other aircrafts (c) remain on autopilot, and then assume the piloting function of that unique operational aircraft (a) in order to land it; and**
 - e) remote pilot can individually and sequentially repeat the landing process (d) for each unique ID operational aircraft, from the plurality of operational aircraft (c), until each unique ID aircraft has been landed.**
- 24. (Currently Amended) A remote pilot system, as in claim 1, in which the remote pilot simulator with any combination of the following:**

- a) **has a simulation of the aircrafts' Mode Control Panel/Flight Control Unit and/or Control Display Unit to transfer data to Autopilot/Flight Director(FD), Autothrottle, etc.;**
 - b) **electronically assimilates the Target State (TS) Report and/or Trajectory Change (TC) for transfer to ATC/M; and**
 - c) **electronically transfers the Minimum Aviation System Performance Standards for Automatic Dependent Surveillance Broadcast (ADS-B), June 25, 2002, RTCA/DO-242-A to ATC/M for maintaining safety of flight and control of the airspace.**
- 25. (Currently Amended) A remote pilot system, as in claim 1, in which the simulator provides a dual piloting control function that allows the simulator to be manned and controlled by either a remote pilot and/or remote copilot.**
- 26. (Currently Amended) A remote pilot system, as in claim 1, which includes all of the limitations of claim 4, claim 5, claim 6 and claim 14, arranged to save communication system bandwidth by having an operational aircraft commence transmitting its unique aircraft identification (ID) and performance and control sensor data to a central ground-based processing station only when the onboard pilot or the remote pilot notifies the other party of the commencing data transmission.**
- 27. (Currently Amended) A remote pilot system, as in claim 1 in which there are a plurality of remote pilot simulators capable of concurrently taking over the piloting of a specific number of operational aircraft.**
- 28. (Currently Amended) A remote pilot system, as in claim 1, for Executive (small to medium sized) Aircraft, Passenger/Carrier Aircraft, Cargo Aircraft and large Military Aircraft, in which the operational aircraft is designed or modified to have only one pilot seat.**
- 29. (Currently Amended) A remote pilot system, as in claim 1, for Executive (small to medium sized) Aircraft, Passenger/Carrier Aircraft, Cargo Aircraft and large Military Aircraft, in which the operational aircraft is designed or modified to have only one set of pilot control avionics.**

- 30. (Currently Amended) A remote pilot system as in claim 1, for Executive (small to medium sized) Aircraft, Passenger/Carrier Aircraft, Cargo Aircraft and large Military Aircraft, in which the operational aircraft displays and controls are reduced from a dual pilot system to one set of pilot displays and controls.**
- 31. (Currently Amended) A remote pilot system, as in claim 1, supplemented with a remote pilot command via telemetry to a specified stationary aircraft sitting on an airport tarmac that effectively shuts down and/or prevents an aircraft's engines from being turned on.**
- 32. (Currently Amended) A remote pilot system, as in claim 28, where the remote pilot effectively shuts down and/or prevents an aircraft's engines from being turned on for a plurality of aircraft at an airport or airports.**
- 33. (Currently Amended) A remote pilot system, as in claim 1, where the remote pilot must enter a unique pilot's identification code via a keyboard to operate the high fidelity virtual reality simulator.**
- 34. (Currently Amended) A remote pilot system, as in claim 1, where the simulator must recognize an authorized pilot's unique fingerprint, and/or voice print, and/or facial characteristics and/or eye characteristics to operate the high fidelity virtual reality simulator.**
- 35. (Currently Amended) A remote pilot system, as in claim 1, where the high fidelity virtual reality simulator is located in a high security site that limits access to only authorized personnel.**
- 36. (Currently Amended) A remote pilot system, as in claim 1, where the cipher code of claim 14, utilized for two-way communication, ground to aircraft and aircraft to ground, can be periodically altered by the remote pilot.**
- 37. (Currently Amended) A remote pilot system, as in claim 1, where a pre-flight check out mode is installed such that the onboard pilot can assure that the remote piloting mode is operational and functional by checking the aircraft's response to commands.**

- 38. (Currently Amended) A remote pilot system, as in claim 1, where an in-flight check out mode is installed such that the onboard pilot can assure that the remote piloting mode is operational and functional by checking the aircraft's response to commands.**
- 39. (Currently Amended) A remote pilot system, as in claim 1, where a pre-flight check out mode is installed such that the remote pilot can assure that the remote piloting mode is operational and functional by checking the aircraft's response to commands.**
- 40. (Currently Amended) A remote pilot system, as in claim 1, where an in-flight check out mode is installed such that the remote pilot can assure that the remote piloting mode is operational and functional by checking the aircraft's response to commands.**
- 41. (Currently Amended) A remote pilot system, as in claim 1, where in order to save RF bandwidth, the aircraft(s) performance and control parameters necessary for remote control of aircraft(s) that get continuously transmitted to the ground, are limited to only the unique aircraft identification (ID) and performance and control parameters (e.g.: 3-d position and attitude) required by ATC/M to track the aircraft's trajectory until either the onboard pilot notifies the remote pilot of the onboard pilot's desire for the remote pilot to assume the piloting function of the aircraft, or the remote pilot notifies the onboard pilot that the remote pilot will be assuming the piloting function of the aircraft, or the onboard pilot notifies ATC/M of an emergency aboard the aircraft.**